PRELIMINARY Health Assessment for

WESTLAKE LANDFILL

BRIDGETON, ST. LOUIS COUNTY, MISSOURI

MOD079900932

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

Comments Period Ends:

THE ATSDR HEALTH ASSESSMENT: A NOTE OF EXPLANATION

Section 104 (i) (7) (A) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, states "...the term 'health assessment' shall include preliminary assessments of potential risks to human health posed by individual sites and facilities, based on such factors as the nature and extent of contamination, the existence of potential pathways of human exposure (including ground or surface water contamination, air emissions, and food chain contamination), the size and potential susceptibility of the community within the likely pathways of exposure, the comparison of expected human exposure levels to the short-term and long-term health effects associated with identified hazardous substances and any available recommended exposure or tolerance limits for such hazardous substances, and the comparison of existing morbidity and mortality data on diseases that may be associated with the observed levels of exposure. The Administrator of ATSDR shall use appropriate data, risks assessments, risk evaluations and studies available from the Administrator of EPA."

In accordance with the CERCLA section cited, ATSDR has conducted this preliminary health assessment on the data in the site summary form. Additional health assessments may be conducted for this site as more information becomes available to ATSDR.

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

WEST LAKE LANDFILL

SUMMARY

The West Lake Landfill, located in the City of Bridgeton, St. Louis County, Missouri, was proposed for the National Priorities List (NPL) in October, 1989. Soil contaminated with radioactive waste from decontamination efforts at the Cotter Corporation's Latty Avenue plant in Hazelwood, Missouri, was dumped at the landfill in 1973. The radioactive soil was used as cover over refuse and in later years the radioactive soil itself was covered with additional soil and debris.

The area around the landfill consists mostly of industrial buildings and business offices with small residential communities to the south and west. Agricultural river bottom land borders to the west, but it is fast being encroached upon by the development of Earth City. The site is considered to be an Indeterminate Public Health Hazard because the limited available data indicate human health is not currently being affected. Exposures of concern could take place if groundwater contamination spreads, exposed radioactive materials on the northwestern edges of the landfill move off-site, or on-site worker exposure increases. Additional environmental data are needed to further assess the on-site and off-site contamination and help predict future activity.

BACKGROUND

A. Site Description and History

The West Lake Landfill is a 200 acre tract located in the City of Bridgeton, St. Louis County, Missouri (Fig. 1). The tract fronts on St. Charles Rock Road on the northeast side and Old St. Charles Rock Road on the southwest. It is northwest of Interstate 270 and about 4 miles west of the St. Louis Lambert Field International Airport. The tract was owned in its entirety by West Lake Properties from 1939 to 1988. In 1988 most of it was sold to Laidlaw Industries; however, West Lake Properties retained the two radioactively contaminated areas through a subsidiary named Rock Road Industries. Laidlaw Industries operates the landfill under a Missouri Department of Natural Resources (MDNR) permit.

From 1939 to 1987 limestone was quarried at the site. In 1962 landfill operations commenced using old quarry pits to receive municipal refuse, industrial waste, and construction debris. Also located on the property is an active industrial complex producing concrete ingredients and aggregates.

The landfill is located on the historical edge of the Missouri River alluvial valley, with about 75 percent of the site being located in the floodplain. Soils at the demarcation line vary from Missouri River alluvium to upland loessal soil. The present channel of the Missouri River lies just under 2 miles west of the landfill. The floodplain area and new businesses being constructed there are protected by a flood control levee.

The groundwater level in the Missouri River floodplain is generally within 10 feet of the surface. The reported flow is to the northwest from the site toward the Missouri River.

In 1973 approximately 43,000 tons of soil contaminated with uranium and its radioactive decay products were placed in the landfill. The radioactive material consists primarily of uranium (U-238), thorium (Th-230), and radium (Ra-226). The soil came from decontamination efforts at the Cotter Corporation's Latty Avenue plant in Hazelwood where the material had been stored.

In 1980-81, The Radiation Management Corporation (RMC), under contract to the NRC, conducted a detailed radiological survey of the West Lake Landfill. Material was found to have been dumped in two areas (Fig. 2). Area 1 is located near the landfill main office and covers approximately 3 acres. It contains about 20,000 cubic yards of contaminated soil buried about 3 to 5 feet deep. It is located over a former quarry pit which was previously filled with debris. Area 2 covers about 13 acres and lies above 16 to 20 feet of debris. The contaminated soil forms a layer from 2 to 15 feet thick

consisting of approximately 130,000 cubic yards. Some of this contaminated soil is at or near the surface, particularly along the face of the northwestern berm.

In 1983-1984, the University of Missouri-Columbia (UMC) Department of Civil Engineering, under contract to the Nuclear Regulatory Commission, further characterized the site and evaluated potential remedial measures. In 1986, Oak Ridge Associated Universities (ORAU) sampled well water on and close to the landfill to determine if radioactive material had migrated into the groundwater.

Based on the reports of these studies the site was proposed for inclusion on the National Priorities List (NPL) in 1989.

B. Site Visit

On March 21, 1990, representatives of the Missouri Department of Health, the Agency for Toxic Substances and Disease Registry (ATSDR), Environmental Protection Agency (EPA), and MDNR visited the West Lake Landfill site. The president of West Lake Properties led a tour of the area. He showed the group the two areas with radioactive contamination and reviewed the history and current operations at the site.

It was noted during the site visit that the entire facility is now fenced, a security project completed in 1989. Before the fencing, employees present during working hours and security guards after working hours helped prevent unauthorized access. The only persons having regular access to the area are the site's work force.

During the time of the visit, the weather was clear and it had not rained for a few days. Area 1 had a few small puddles of standing water and good vegetative ground cover with no obvious erosion problems. Area 2 had no vegetative ground cover, but had a variety of soil and crushed limestone cover. Drainage was good with the ground being dry except in the northernmost end where some water had pooled. Some recent dumping of apparent construction debris was being used to fill in the low area where the water was standing.

Physical hazards at the site consisted of discarded construction equipment and miscellaneous construction debris. After the NPL site visit a driving tour was conducted of the surrounding off-site area to determine possible routes of exposure, demographics of the area, land use, and the possible population at risk.

C. Demographics, Land Use, and Natural Resource Use

The West Lake Landfill is located in the northwestern portion of the City of Bridgeton, in St. Louis County, Missouri. Earth City Industrial Park is located on the floodplain approximately 1 mile northwest of the landfill. Population density on the floodplain is generally less than 26 persons per square mile; and the daytime population (including factory workers) is much greater than the number of full-time residents.

Major highways in the area include Interstate 70 (I-70) and Interstate 270 (I-270), which meet south of the landfill at Natural Bridge Junction. The Earth City Expressway and St. Charles Rock Road lie, respectively, west and east of the landfill. The Norfolk and Western Railroad passes about 1/2 mile from the northern portion of the landfill. Lambert Field International Airport is located approximately 4 miles east of the West Lake Landfill.

In addition to business/industries at Earth City, plants are operated by Ralston-Purina and Hussman Refrigeration across St. Charles Rock Road. The employees of these two plants probably comprise the largest group of individuals in close proximity to the contaminated areas for significant periods of time. Considering that land in this area is relatively inexpensive and that much of it is zoned for manufacturing, industrial development on the floodplain will likely increase in the future.

Two small residential communities are present near the West Lake Landfill. Spanish Lake Village consists of about 90 homes and is located about 1 mile south of the landfill, and a small trailer court lies across St. Charles Rock Road, 1 mile southeast of the site. Subdivisions are presently being developed 2 miles east and southeast of the landfill in the hills above the floodplain. Ten or more houses lie east of the landfill scattered along Taussig Road. The City of St. Charles is located northwest of the Missouri River at a distance of about 2 miles from the landfill.

Areas south of the West Lake Landfill are zoned residential; areas on the other sides are zoned for manufacturing and business. Most of the landfill is zoned for light manufacturing (M-1). However, some of the northern portion of the landfill is zoned for residential use; this includes the contaminated area around the former Butler-type building site. The field northwest of the landfill between Old St. Charles Rock Road and St. Charles Rock Road is under cultivation. Trends indicate that the population of this area will increase, but the land will probably be used primarily for industrial facilities.

No public water supplies are drawn from the alluvial aquifer near the West Lake Landfill. It is believed that only one private well in the vicinity of the landfill is used as a drinking water supply. In 1981, analysis showed water in this well to be fairly hard (natural origins), but otherwise of good quality.

Water supplies are drawn from the Missouri River at mile 29 for the City of St. Charles, and the intake is located on the north bank of the river. Another intake at mile 20.5 is for the St. Louis Water Company's North County plant.

The City of St. Louis takes water from the Mississippi River, which joins the Missouri River downstream from the landfill. In this segment of the river, the two streams have not completely mixed and the water derived from the Missouri River is still flowing as a stream along the west bank of the Mississippi River channel. Reportedly, the intake structures for St. Louis are on the east bank of the river so that the water drawn is derived from the upper Mississippi.

D. State and Local Health Data

The Missouri Department of Health, State Center for Health Statistics, analyzes and consults on health related information collected from several sources. The Center's Bureau of Health Data Analysis has available statistics information, hospital discharge data, and the Multi-Source Birth Defect Registry. The Multi-Source Birth Defect Registry consists of birth outcome data from the following data sources: birth, death, hospital discharge, Crippled Children's Services, and Neonatal Intensive Care Unit records.

For health assessments, cancer mortality rates by age, sex, and cancer site are calculated to determine whether there is a significant difference between the area of concern and the rest of the state. Birth data include fetal deaths, low birth weight births, and frequency of malformations in the area of concern.

For most of the state, the smallest geographic area that can be studied is defined by a zip code. In the St. Louis metropolitan area, census tract information is available that allows further refinement of the potentially exposed population. However, that may still represent a larger area than is actually affected by a site such as West Lake Landfill and the additional people in the study group may well dilute and obscure any adverse health outcomes, if present.

COMMUNITY HEALTH CONCERNS

Community concern around the area seems to be minimal. However, greater public involvement should be encouraged to better ascertain the exact extent and nature of the concern. Some newspaper articles have been published about the site and its possible hazards. The group of concerned citizens involved in the St.Louis Airport/Hazelwood Interim Storage/Futura Coating Company sites could conceivably become involved out of interest in the origination site or for other reasons.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

A. On-Site Contamination

In 1980-81, a radiological survey of the West Lake Landfill was conducted by the Radiation Management Corporation (RMC) of Chicago, Illinois. External (gamma) radiation levels in microrems per hour (-R/Hr) were measured 1 meter above the ground surface. This survey showed the radioactive contaminants to be located in two areas of the landfill (Fig. 2). Both areas 1 and 2 had places that exceeded 100 -R/Hr with a maximum level as high as 3,000 to 4,000 -R/Hr detected in Area 2 (Fig. 2). The total areas exceeding 20 -R/Hr were about 2 acres in Area 1 and 9 acres in Area 2.

Levels were again measured in May and July of 1981 and found to be significantly lower than the November 1980 sampling, especially in Area 1 where approximately 4 feet of sanitary fill had been added. An equal amount of construction fill was added to most of Area 2. As a result only a few thousand square feet of Area 1 exceeded 20 -R/Hr and the amount of Area 2 exceeding 20 -R/hr had decreased by about 10 percent with a maximum reading of about 1600 -R/hr. 20 -R/hr criterion was derived from the NRC's Branch Technical Position, 46 FR 52061, October 23, 1981, which aims at exposure rates less than 10 -R/hr above background levels. Background radiation in the area is about 10 -R/hr.

Surface Soil Analysis

Surface soil samples were gathered and analyzed on site for gamma activity. In all 61 surface soil samples only uranium and/or thorium decay chain nuclides and K-40 (potassium 40) were detected. On-site samples ranged from about 1-21,000 picocurie per gram (pCi/gram) for Radium 226 (Ra-226) and from less than 10 to 2,100 pCi/gram Uranium 238 (U-238). Off-site background samples were on the order of 2 pCi/gram for Ra-226. In samples in which elevated levels of Ra-226 were detected, the concentrations of U-238 were generally one-half to one-tenth of those of Ra-226. In cases of elevated sample activity, daughter products of both U-238 and U-235 were

found. In general, surface activity was limited to Area 2, with only two small regions in Area 1 showing surface contamination.

Subsurface Soil

Subsurface soil was measured by the drilling of 43 holes, with holes being drilled in known contaminated areas and then additional holes being drilled at intervals in all directions. Concentrations of Ra-226 ranged from less than 1 pCi/gram to 22,000 pCi/gram.

Groundwater

In 1981, 41 water samples were taken and analyzed by RMC, but only 10 were shallow groundwater standing in bore holes. Of these 10 samples only one equaled the EPA gross alpha activity standard for drinking water of 15 picocurie per liter (pCi/L). Four of the groundwater samples exceeded 30 pCi/L gross beta activity, with most of the beta activity coming from naturally occurring K-40 as determined from subsequent isotopic analysis. Background activity is estimated as 1.5 pCi gross alpha activity per liter and 30 pCi gross beta activity per liter.

In 1983 and again in 1984 eleven perimeter wells were sampled for gross alpha and gross beta. In two years of sampling, only 1 well each year exceeded the 15 pCi/L drinking water standard (18.2 pCi/L in 1983 and 20.5 pCi/L in 1984). Only one well in 1983 exceeded 30 pCi/L gross beta activity level at 33.1 pCi/L gross beta.

In 1986 Oak Ridge Associated Universities (ORAU) personnel took water samples from 44 perimeter wells. Only one well with 17 pCi/L of alpha activity exceeded the drinking water standard, and only two wells with 46 and 47 pCi/L gross beta activity exceeded the 30 pCi gross beta activity that was assumed to be the background activity from earlier data.

Vegetative

No elevated radioactivity was found by RMC in vegetation consisting of on-site weed samples and farm crop samples (winter wheat) located near the northwest boundary of the landfill. This crop location was chosen for sampling because water could run off from the fill onto the farm field.

Air

Both gaseous and particulate airborne radioactivity, specifically radon and its daughters, were sampled and analyzed between May and August of 1981. These were sampled because of the known materials that consisted partially or totally of

uranium ore residues. A total of 111 samples from 32 locations were sampled and radon flux levels ranged from 0.2 pico curie (pCi) per square meter-second in low background areas to 865 pCi per square meter-second in areas of surface contamination. A set of 10-minute, high-volume particulate air samples was taken to determine both short-lived radon daughter concentration and long-lived gross alpha activity.

The highest levels (0.031 WL) were detected in November 1980, near and inside the Butler-type building, that has since been removed. These two samples approximately equal NRC's 10 CFR Part 20, Appendix B, alternate concentration limit of one-thirtieth WL for unrestricted areas.

The high ratio of Th-230 to Ra-226 radioactivity indicates that decay of Th-230 will increase the concentration of its product, Ra-226, until the two radionuclides are in equilibrium. It is estimated that the Ra-226 activity will increase by a factor of nine 200 years from now, and by a factor of thirty-five 1000 years from now. All radionuclides in the decay chain after Ra-226 (and the Ra-222 gas flux) will be increased by similar multiples.

Other Contaminants

The site has been a landfill since 1962. Prior to regulation by the DNR, it is believed that the landfill may have accepted such materials as organics and inorganics, heavy metals, solvents, pesticides, paints and pigments, acids, bases, sewage sludge, as well as small quantities of unknown hazardous waste. This is based on notification as required by CERCLA 103(c) in 1981 and may not be an accurate representation of what was actually dumped in the landfill.

The sampling data available for the site have not demonstrated significant contamination of chemicals in the groundwater. Burns and McDonnell, in a 1986 report on the hydrogeology of the site, reported to have found only methylene chloride, bis (2-ethylhexyl) phthalate, and phenol in identifiable quantities in 2 rounds of sampling (December 1985 and May 1986). They also reported that the general distribution of the organic constituents was scattered and irregular. In round 2 of the sampling, the presence of methylene chloride was attributed to the analytical method. In general, the detection of organics and heavy metals was scattered and irregular, leaving inconclusive evidence as to the contamination of the landfill by these materials.

B. Off-Site Contamination

Off-Site contamination from the West Lake NPL site has not been confirmed. The Missouri Department of Health has sampled a number of private wells in the area most likely to be

contaminated. Four private wells were sampled in 1988 and 1989 and no gross alpha activity above the EPA drinking water standard of 15 pCi/l was found.

The haul road from the Latty Avenue site in Hazelwood could possibly have some low level residual contamination, but no data is available at this time and the possibility of obtaining additional data is being investigated.

C. Quality Assurance and Quality Control

In preparing this Preliminary Health Assessment, MDOH relied on the information provided in the referenced documents and assumed adequate quality assurance and quality control measures were followed with regard to chain-of-custody, laboratory procedures, and data reporting. The validity of the analysis and therefore the conclusions drawn for this Preliminary Health Assessment are predicated on this reliance.

D. Physical and Other Hazards

Physical hazards at the site consist of discarded construction equipment and miscellaneous waste construction debris around Area 2. The area is fenced and only workers at the site would be expected to be exposed to possible hazards.

PATHWAYS ANALYSES

As discussed in the Site Description and History Subsection, the dumping of approximately 43,000 tons of soil contaminated with uranium and its radioactive decay products has polluted the West Lake Landfill.

A. Environmental Pathways (Fate and Transport)

Radioactive contaminated soil was used to cover debris and municipal waste at the West Lake Landfill. The contaminated soil has since been covered over with clean soil and remains exposed only in an area on the northwestern berm. Erosion of this soil by surface water run-off would spread radioactive contamination to the farm field west of the site and/or to the Creve Coeur Creek. The creek has no known recreational purposes and is not expected to be used for a water source. Approximately two miles downstream, the creek enters the Missouri River.

Water supplies for the City of St. Charles are drawn from the opposite (north) bank of the river. The next known water intake is the St. Louis Water Company North County Plant, which is approximately 8.5 miles further downstream.

Wind erosion of dust from the berm is not expected to be a pathway of concern except in very dry conditions or during disturbance. The landfill is located on the historical edge of the Missouri River alluvial valley with about 75 percent of the site being located in the floodplain. There are two aquifiers at the site consisting of the Missouri River alluvium and the shallow limestone bedrock. Below the shallow limestone is the relatively impermeable Warsaw shale that acts as a barrier making contamination of the deeper limestone aquifer very unlikely. The shale layer has been reached by quarrying operations but has not been disturbed.

Groundwater flow in the river floodplain varies slightly with conditions and tends to flow northwest toward the river or north under high river conditions, closely paralleling the river. The groundwater level is generally with 10 feet of the floodplain surface. No public water supplies are drawn from the alluvial aquifier near the West Lake Landfill. Any leachate would be expected to become diluted upon reaching the alluvial groundwater.

The air pathway includes ionizing radiation and Rn 222. The ionizing radiation can penetrate air and nominal thickness materials. Radon (Rn 222) is an inert, radioactive gas and migrates easily through air.

Farming of the river bottom was done in the past east of the landfill, but is rapidly declining as the land is being developed for new businesses/industries in the Earth City complex. Fishing in the Missouri River would be the only recreation activity that would be expected to occur in close proximity to the site.

B. Human Exposure Pathways

With the landfill being fenced, direct exposure to the contaminated soil on the northwest berm to the public is not considered a viable route of exposure. If the soil was eroded from the site by either wind or water, exposure to radioactive materials could take place.

Groundwater in the area is not used for municipal purposes, but a few private wells in the area are used for domestic purposes and irrigation. Four of the most adjacent wells to the landfill have been monitored by the MDOH for the last couple of years and have shown no contamination above EPA's gross-alpha activity standard for drinking water. The wells were also analyzed for a number of pesticides and they were below detectable limits.

Surface water from the Missouri River used as a municipal supply for the City of St. Charles is not expected to be affected by the landfill. The city draws its water from the

west bank where mixing has not occurred yet. The City of St. Louis Water Company North County Plant takes its water from the Missouri River at mile 20.5 where significant dilution of any possible contaminants from the landfill has already occurred. Radon (Rn 222) exposure to the public is not expected to be a problem since the area is fenced and there is no public access.

The maximum measured level of 0.031 WL is very close to the NRC alternate concentration limit of one thirtieth (0.033) WL for unrestricted areas, but only on-site workers are expected to be exposed, and then only for a short period of time. The possibility does exist that, in the future, increased levels of radon will be present as the material seeks equilibrium.

Vegetative weeds and crops are not expected to be a pathway of exposure. No elevated radioactivity was detected in on-site weeds or farm crops near the site.

Fish caught from the Missouri River are not expected to be affected by the West Lake Landfill because there has not been a known route of exposure.

PUBLIC HEALTH IMPLICATIONS

As discussed in the Environmental Contamination and Other Hazards and Pathways Analyses Sections, no exposure is known to be occurring to residents around the site. The few private wells in the vicinity have not shown any contamination from the West Lake Landfill; however, on-site monitoring well sampling has revealed migration of uranium into the groundwater.

The majority of the area is served by a public water system with no source wells in the area. Direct exposure of the public to ionizing radiation is not expected because of restricted access to the site. Exposure to on-site workers is expected to be of small concern because the time spent in contaminated areas is brief and can be monitored and controlled to minimize cumulative exposure.

A. Toxicological Implications

Contaminants present at the landfill are Uranium-238 (U-238), Thorium-230 (Th-230), Radium-226 (Ra-226), and Radon-222 (Rn-222) with half-lives of approximately 4.5×10^9 years, 80,000 years, 1600 years, and 3.8 days, respectively. These radionuclides, members of the uranium decay chain, emit alpha particles and gamma rays. At this site, the uranium, thorium and radium are nearly completely covered with clean fill so as to not present a significant direct dust inhalation or ingestion potential. Therefore, the exposures of most interest would be inhalation of radon and its daughters and ingestion of radioactively contaminated groundwater.

Radon gas, produced by the decay of radium, diffuses up through the soil cover and mixes with the air above it where it may be breathed. Rain falling on the soil cover percolates down into and through the contaminated layers, picks up radioactive particles, and delivers them to the groundwater where they may eventually reach drinking water wells. Additionally, rain may erode contaminated soil from the northwest berm area and deposit it in the adjacent field where crop uptake is possible.

Rn-222 has been shown to be carcinogenic, producing lung cancers when inhaled, based principally on studies of uranium miners. Although radon gas itself is inert, some will be absorbed into the blood from the lungs and transported throughout the body, the rest will be exhaled. However, the radon decay products (daughters) are charged particles. When inhaled, either directly or attached to other airborne particulate matter, they deposit on lung surfaces and lodge in the mucosa. As the radon daughters decay, they emit alpha particles, the major health hazard associated with radon gas exposure. The alpha particles are potent ionizers, but do not travel far in tissue due to their relatively large size. (7,8)

The principal health effect of this ionizing radiation in humans is cancer induction and the most important target tissue is the bronchial epithelium. Inhaled radon daughters, due to their short half-life, emit their alpha particles in the lung before they move on to other organs. Radon exposed smokers are at greatly increased risk of respiratory tract cancer due to the multiplicative interaction of the dual exposure. (8)

By convention, radon exposure is measured in terms of working levels (WL) and cumulative exposures over time are measured in working level months (WLM). One WL is defined as any combination of the short-lived radon daughters in 1 liter of air that results in the ultimate release of 1.3×10^5 MeV (million electron volts) of alpha particle energy. This is approximately the amount of alpha energy emitted by the short-half-life daughters in equilibrium with 100 pCi of radon. (8)

Given that the highest level detected on site was 0.031 WL and that that level is very close to the Nuclear Regulatory Commission (NRC) alternate concentration limit of one-thirtieth (0.033) WL for unrestricted areas (2), it does not appear that unacceptably high exposure is occurring at present.

Additionally, the population at risk, on-site workers, would not experience continuous exposure at the highest level. Rather, their actual cumulative exposure would be to the weighted average of their work location levels. This average would be well below the NRC concentration limit. There is insufficient information available on the actual exposure of workers to further characterize the risk.

Since the radioactive material at the site is not a natural undisturbed deposit, the radionuclides are not in equilibrium with each other. It is to be expected that the concentration of radon gas will increase significantly in the future. Therefore, much higher exposure potentials are possible.

Soluble forms of U-238, when ingested, are chemically toxic to the kidney, producing tissue damage in the proximal tubules and consequent functional impairment. The tissue will regenerate and function return if exposure ceases. This chemical toxicity is of much greater significance than the potential for ionizing radiation effects since the soluble forms are excreted from the body rather quickly. Conversely, insoluble forms may be retained in the body for a long time and the radiation effects become paramount. Target organs are principally the bone marrow and lymphatics and exposure may result in radiation-induced cancer. (3,4)

Thorium is relatively inactive chemically and, therefore, is of concern only as a chronic radiation hazard. Little of an ingested dose of thorium is retained in the body; but, once deposited, it remains for a long time. The bones, lungs, and lymphatics are the primary depositories.

Radium is highly radiotoxic. It is handled metabolically the same as calcium and, therefore, is deposited in the skeleton where it serves as a source of alpha radiation of bone and adjacent tissues. Studies of radium dial painters have clearly demonstrated excess bone cancer in heavily exposed groups. However, low exposures have shown relatively much less risk of bone cancer than would be predicted from a simple straight line extrapolation from the high exposure data. (3)

B. Health Outcome Data Evaluation

The MDOH State Center for Health Statistics studied cancer deaths and natality data for the years 1981-1988 for the census tracts most likely to be affected by the West Lake NPL site. (Fig. 3) Using statewide cancer death rates, the expected number of deaths was calculated for the West Lake area. This number was then compared to the actual (observed) number of deaths and a test of statistical significance performed. "Statistical significance" means that any noted difference between the two numbers is probably not due just to chance.

Cancer deaths were looked at by type of cancer for various age groups, for all types combined for age groups, and for total cancer deaths for all age groups combined. Cancer of the kidney in the 45-64 age group was the only comparison that achieved statistical significance. There were 3 observed deaths in this group when less than 1 would have been expected. Small numbers like this, however, may not allow meaningful analysis and it is unknown if these persons actually experienced any exposure.

Fetal deaths and low birth weight (less than 2500 grams) were studied for years 1981-1988. The observed number of fetal deaths was not significant compared to the expected value. The number of observed low birth weights for the site area was significantly lower than expected.

A study of 1981-1986 births did not reveal an observed number of anomalies significantly different from expected, based on the state rate. This study was based upon aggregated birth and death certificates, hospital discharge, Crippled Children's Service, and neonatal intensive care unit data.

These studies neither confirm not deny a health threat to the population potentially at risk from the West Lake Landfill. The census tracts located between the Missouri River and Highway 270 in north St. Louis County which is the smallest definable area for these studies, include a much larger geographical area and larger population than would actually be affected by this site, therefore, any adverse health effects might be obscured.

CONCLUSIONS

From the information reviewed, the West Lake Landfill is judged to be an Indeterminate Public Health Hazard. Emissions of Rn-222 into the air with levels expected to increase in the future, contaminants with an easy route for leaching into the groundwater, exposed radioactive contamination on the berm, and the possibility of off-site haul road contamination, all provide a possible route of exposure to the public in the vicinity of the West Lake Landfill.

RECOMMENDATIONS

Recommendations for the West Lake Landfill include remedial actions to protect public health and the acquisition of additional site characterization information. Recommended remedial actions to prevent public exposure include preventing Rn-222 levels in the air from increasing, and preventing contaminants from entering the groundwater system. Action should be taken to cover the exposed contaminated materials to minimize the possibility of erosion. Additional site characterization should continue with the sampling of the roads used to transport contaminated materials into the West Lake Landfill and continued monitoring of the groundwater.

When indicated by public health needs, and as resources permit, the evaluation of additional relevant health outcome data and community health concerns, if available, is recommended.

This preliminary health assessment is currently being evaluated by ATSDR to determine if follow-up health activities are indicated for the population around the West Lake Landfill site. ATSDR's recommendation will be included in this preliminary health assessment before it is finalized.

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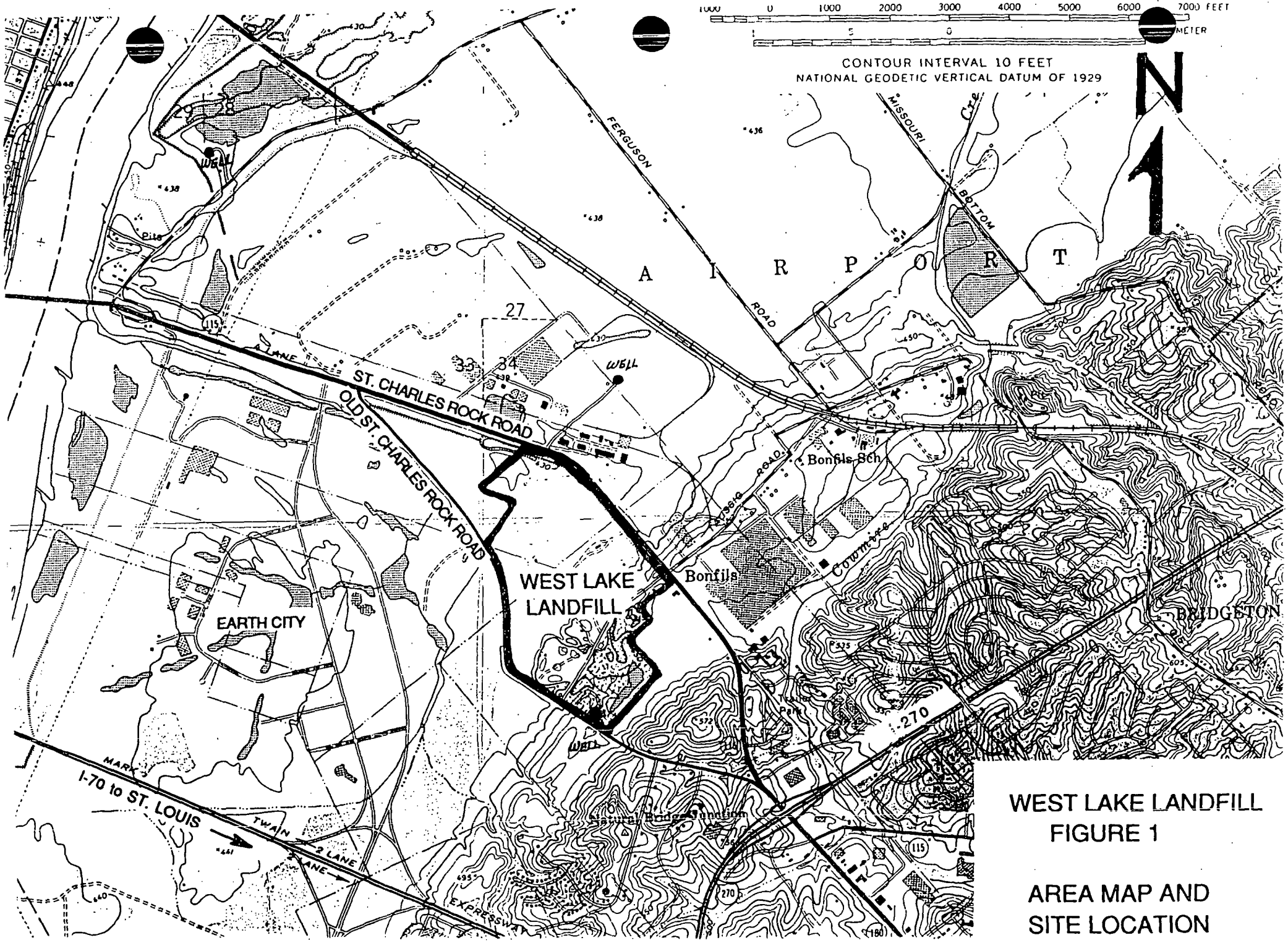

WEST LAKE LANDFILL
FIGURE 1

AREA MAP AND
SITE LOCATION

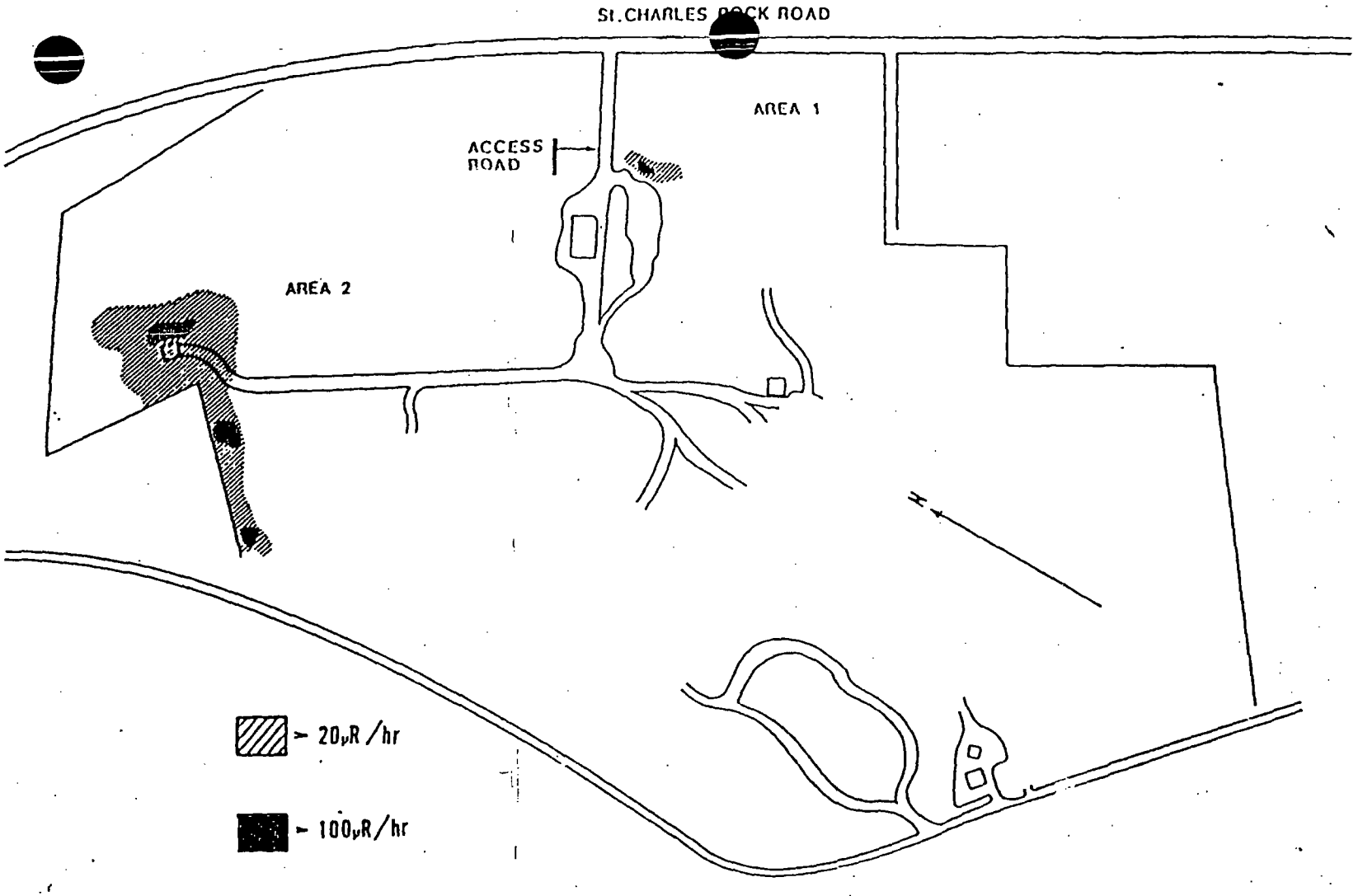

Figure 2 External gamma radiation levels, May, 1981

SOURCE: NRC, Radiological Survey of the Westlake Landfill, St. Louis Co., MO 1982

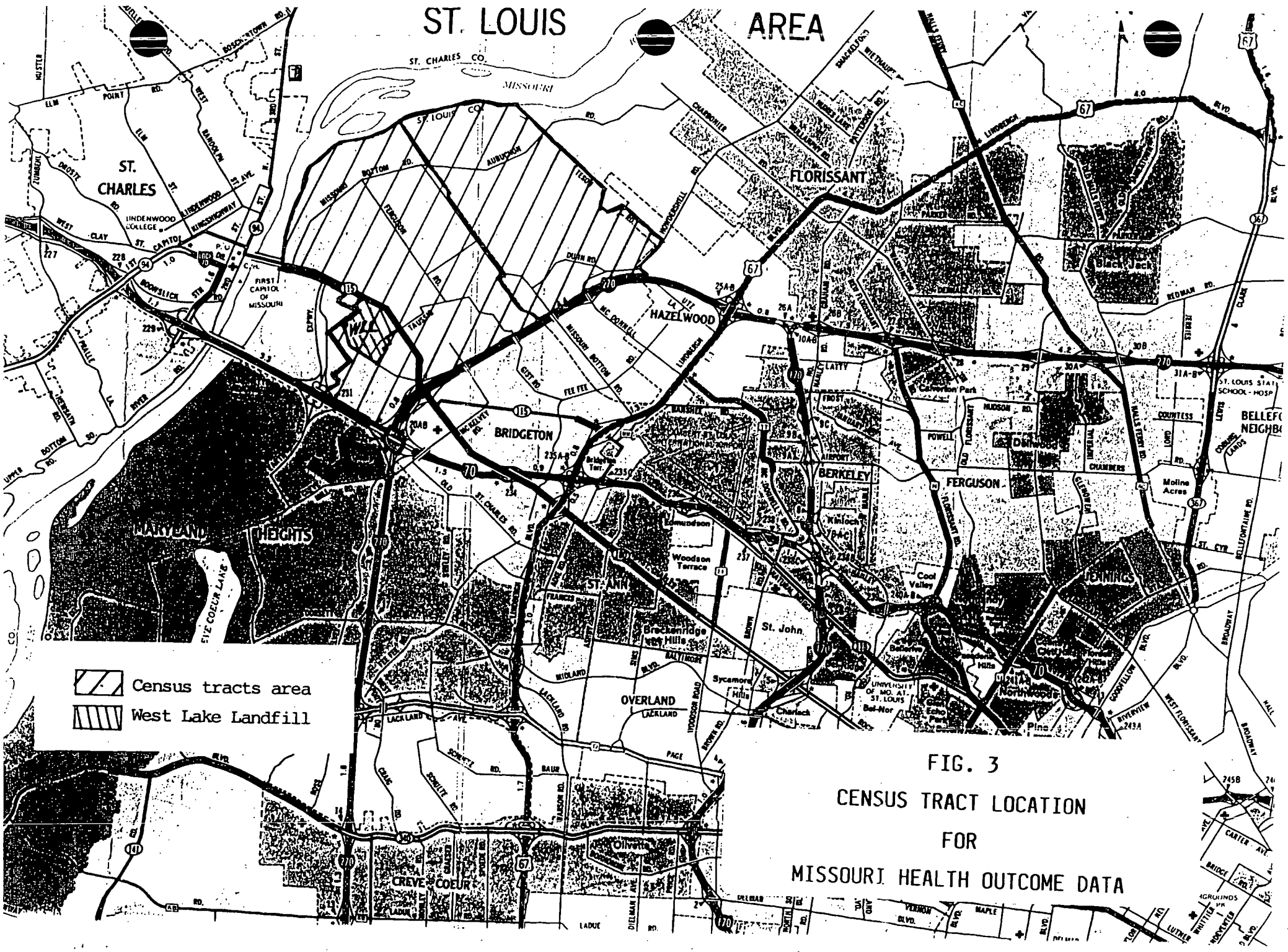

FIG. 3

CENSUS TRACT LOCATION

FOR

MISSOURI HEALTH OUTCOME DATA